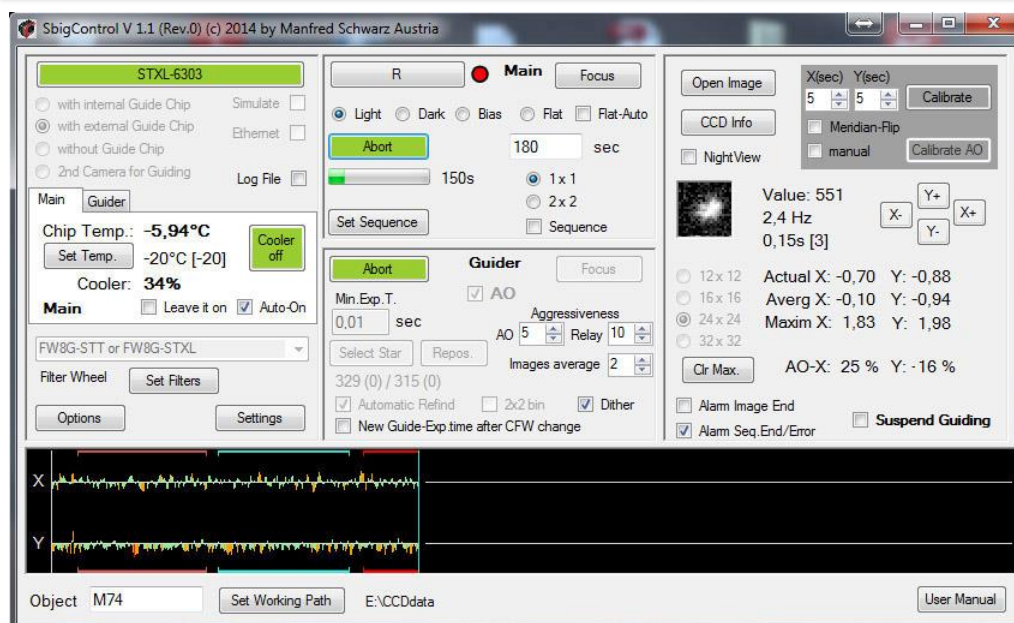


SbigControl – User Manual



Version of Software: 1.1

Version date of manual: February 7th 2015

Homepage: <http://www.astrophoto.at>

Email: ms@astrophoto.at, Manfred Schwarz

User Group: <https://groups.yahoo.com/neo/groups/SbigControl/info>



Features

- **Supports Adaptive Optics AO** and also AO-X (some other programs do not support it)
- **Supports internal-/ external-guider chip and separate guider camera**
- **Sequence** – you can define your full imaging program of an object for a night and let it work automatically
- **Refind guide star** – if a guide star is lost SbigControl can find it again automatically
- **Dithering**
- **Automatic save of images** in an automatically created folder structure
- **Automatic change of guiding exposure time** during guiding if star brightness changes
- **Automatically find of optimal Flatfield exposure time**
- **Open shutter during guiding without imaging** (most software turns the shutter off permanently)
- **Selectable acoustic alarm** for end of image, end of sequence, or error condition
- **Log file** for imaging, with time stamps and much more data
- **Many user changeable parameters** to customize the software for your needs
- **Easy to use** – SbigControl is developed by a user (me) who has worked over the last 12 years, with Sbig cameras

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Copyright

You can use copies of this purchased software on different computer for your personal use. Please do not copy it for other persons. I have spent much time creating this software and worked full-time to develop and make it better for you. The price of the program is fair, please also be fair. ☺

Credits

Many thanks to John Galle for correction of my bad English in this manual!

Many thanks to all helpful users, who were tested the preliminary releases!

Many thanks to SBIG with their great support!

Many thanks to all users who sent and send me comments, ideas and hints about bugs!

General description and system requirements

SbigControl is an application to control SBIG cameras with USB or Ethernet interface from Santa Barbara Instrument Group.

You can control camera systems with main chip only or main chip with internal or external remote guide chip or extra guide cameras like STi.

This application was tested with several Sbig cameras and accessories, but not with every model and combination! If you have trouble with your combination, please report it in the Yahoo user group or by email.

Please note that there is no guarantee that using SbigControl will not affect other software or the hardware.

I, Manfred Schwarz, developer, am not liable for such issues, problems or any damages!

System requirements:

- Win 7 or higher (Tested with Win 7 pro 32 and 64bit, Win 8 64bit and Win 8.1 pro 64bit)
- 2GB memory (more is better)
- Screen resolution 1024 x 768 (more is better)
- Microsoft Visual C++ Redistributable 2013 (X86)
- For Win 7: Microsoft .NET framework 4.5.x installed (e.g. 4.5.1)
- Sbig camera with USB connection or Ethernet connection
- Latest SBIGDriverChecker64 (<http://www.sbig.com>) and latest Sbig drivers
- Guiding only via telescope port of Sbig camera

Installation

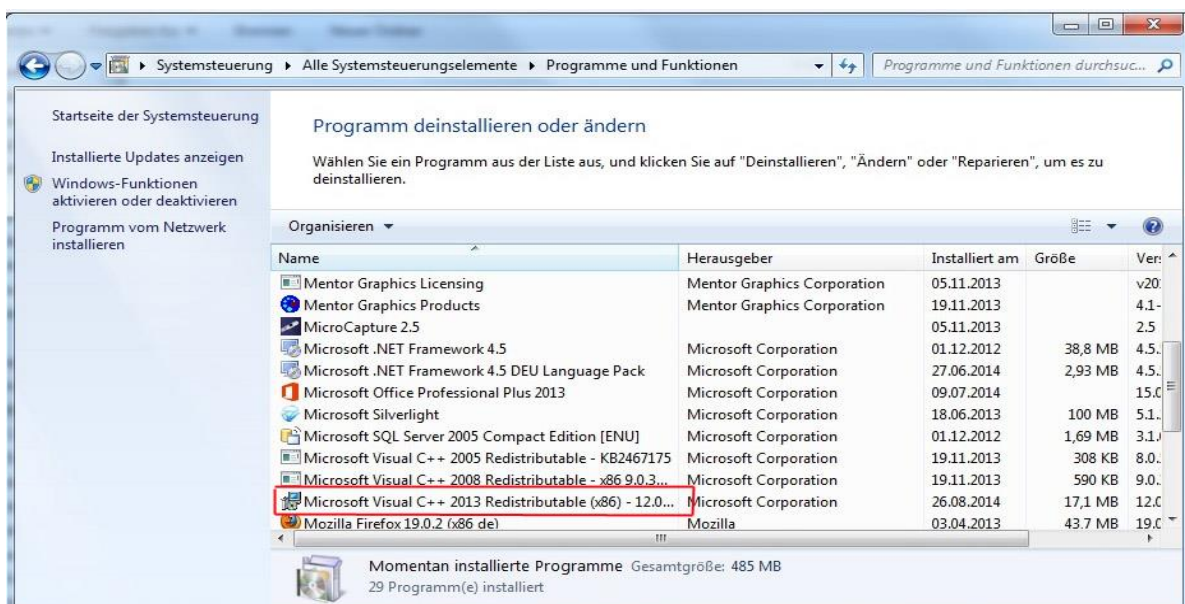
Download the setup.exe file from given link (if you haven't one, send an email to ms@astrophoto.at). If your web browser gives you a warning to avoid downloading executable files, please ignore it. Depending on your browser, there are different ways to force it to download an .exe file.

Start the setup.exe.

Follow the installation by pressing "Next", ... until it is finished.

Check, if necessary, that the Microsoft components are installed:

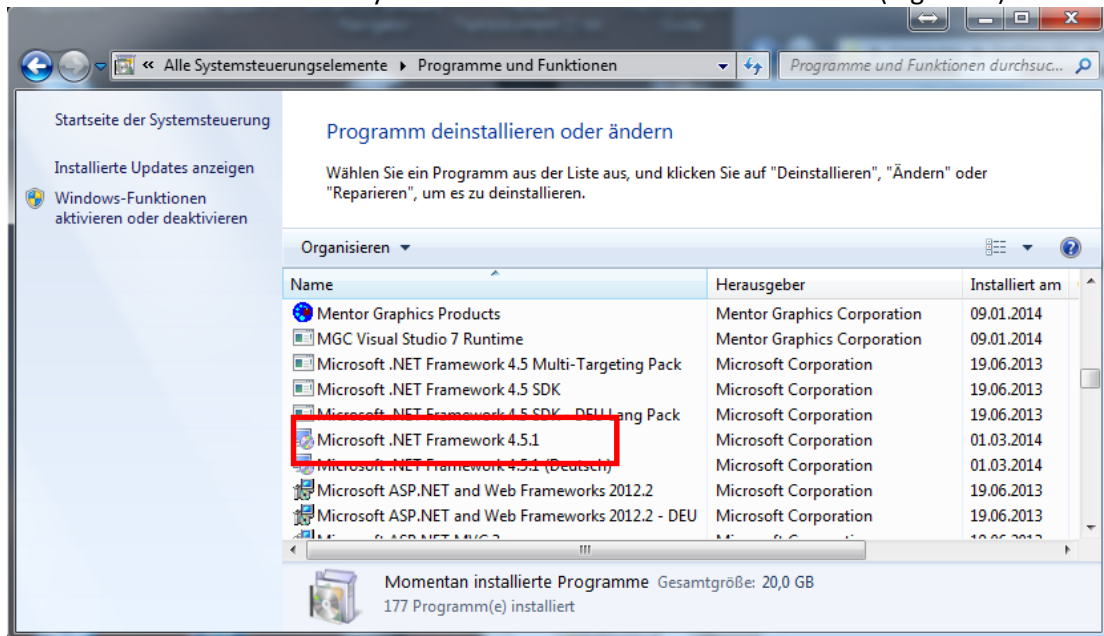
- Open "Control Panel"
- Open "Programs and Features"
- Look if there is an entry with: "Microsoft Visual C++ 2013 x86 Redistributable"



If : "Microsoft Visual C++ 2013 x86 Redistributable" isn't installed, then download "vcredist_x86.exe" from: http://www.astrophoto.at/SbigControl/vcredist_x86.exe and install it.

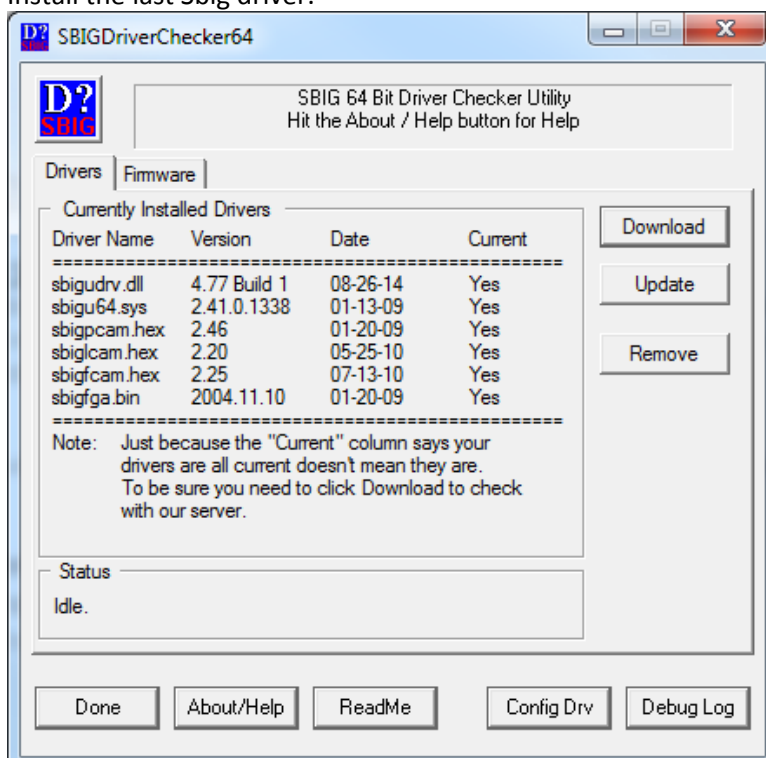
If you use Win 7, check if .NET 4.5.x is installed (Win 8 includes .Net 4.5):

- Open "Control Panel"
- Open "Programs and Features"
- Look if there is an entry with: "Microsoft .NET Framework 4.5.x" (e.g. 4.5.1)



If .NET Framework 4.5 isn't installed, then download "dotNetFx45_Full_setup.exe" from http://www.astrophoto.at/SbigControl/dotNetFx45_Full_setup.exe and install it. During installation of .NET, you will need an internet connection.

Install the last "SBIgDriverChecker64" from <http://www.sbig.com/support/software/>
Install the last Sbig driver.



Note, there is no entry in the registry! If you want to uninstall the software, you have only to start
C:\SbigControl\unins000.exe
You can be sure that no remnants remains!

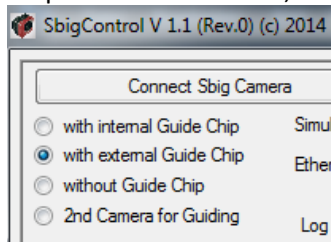
Difference between Demo-Version and Full-Version

There is only one thing different in the Demo-Version: The files will not be stored automatically. Instead, a Demo-FIT-file is stored into the working area to show you the auto-save-structure. Therefore, it is possible to verify all functions and see the result on screen.

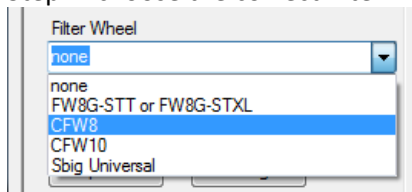
Quick Start

If you want to start very quickly, read this chapter, but you really should read the full detailed description following this chapter!

Step 1: Choose internal, external or no guide chip or extra camera for guiding

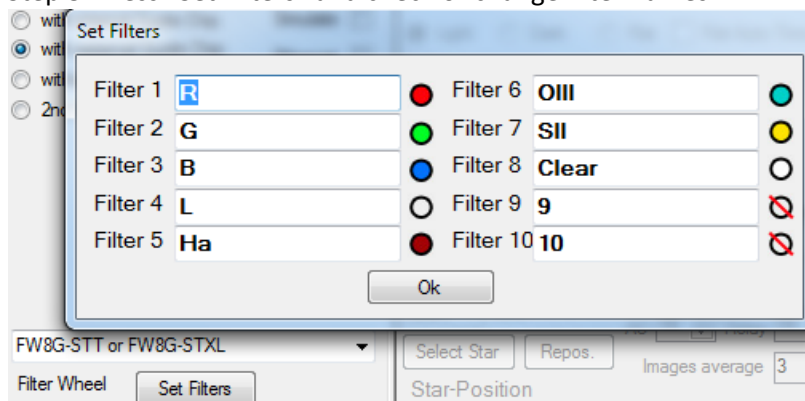


Step 2: choose the correct filter wheel



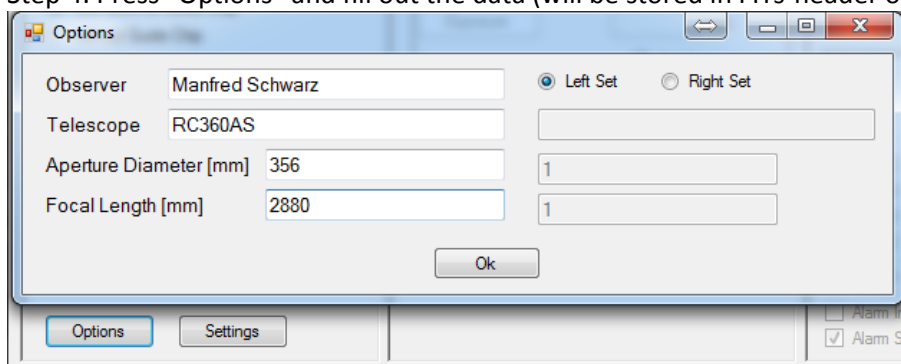
If your filter wheel isn't in the list, choose "Sbig Universal"

Step 3: Press "Set Filters" and check or change filter names



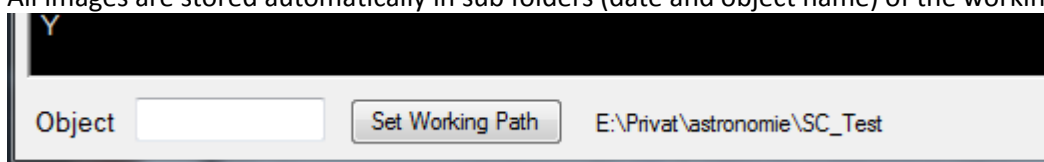
Press on the colored filter symbol to change it to the desired color.

Step 4: Press "Options" and fill out the data (will be stored in FITs-header of images)

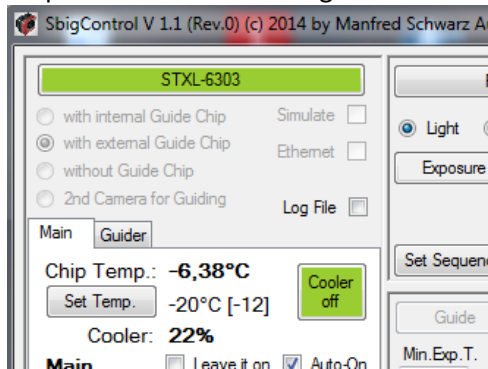


Step 5: Choose Working Path by pressing "Set Working Path"

All images are stored automatically in sub folders (date and object name) of the working path.

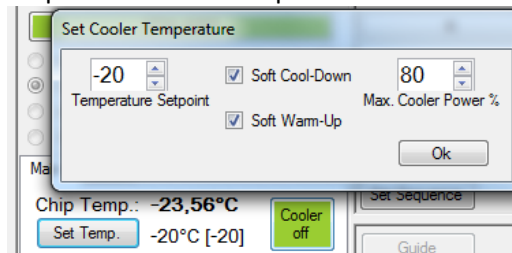


Step 6: Press "Connect Sbig Camera"



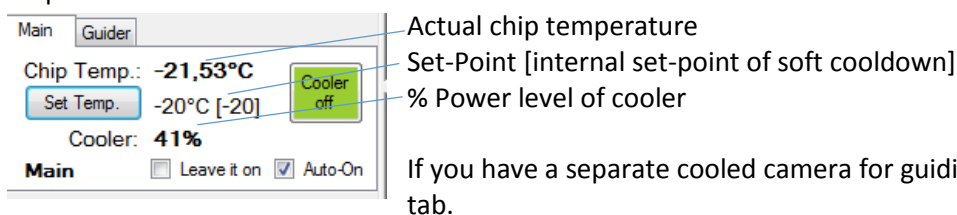
Your camera model is shown in the "Connect" button.

Step 7: Press "Set Temp" to set the cooler temperature



If you check "Soft Cooldown" you can set your desired target temperature and SbigControl will cool down in soft steps to avoid freezing of the chip.

Step 8: Press "Cooler On" to start the cooler



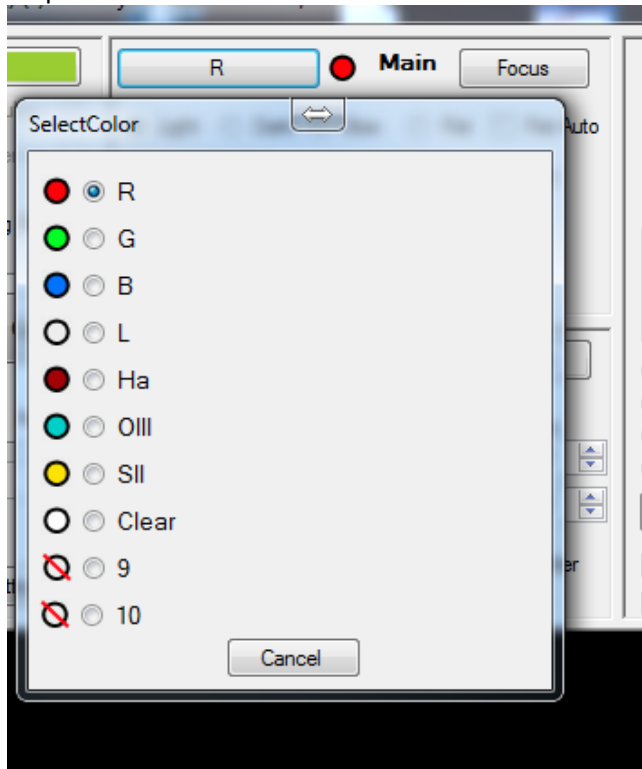
Actual chip temperature

Set-Point [internal set-point of soft cooldown]

% Power level of cooler

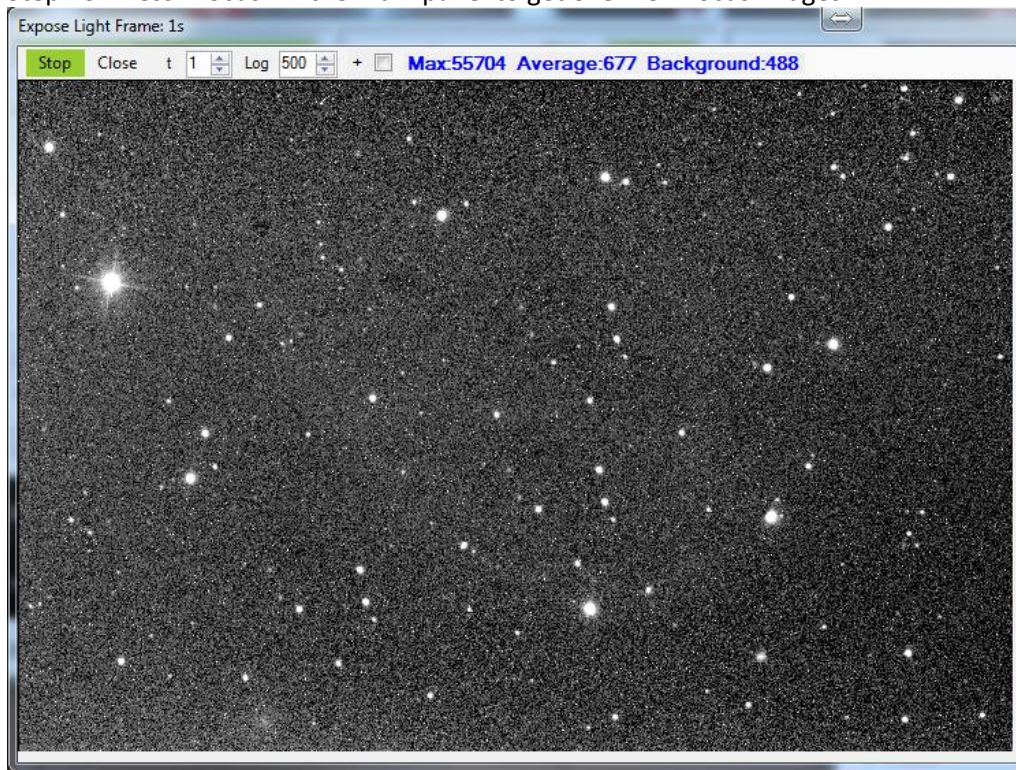
If you have a separate cooled camera for guiding, click on "Guider" tab.

Step 9: Press color button to choose a filter



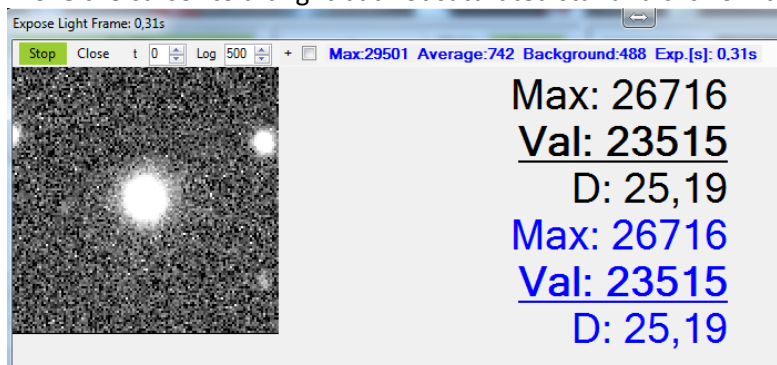
Select required filter (e.g. "L").

Step 10: Press “Focus” in the main panel to get overview focus images



Focus broadly and press “Stop”.

Move the cursor to a bright but not saturated star and click on it.



Maximum ADU value in the field
Value of the center area of the star
Diameter of the star in pixel

Storage of the best values in this session

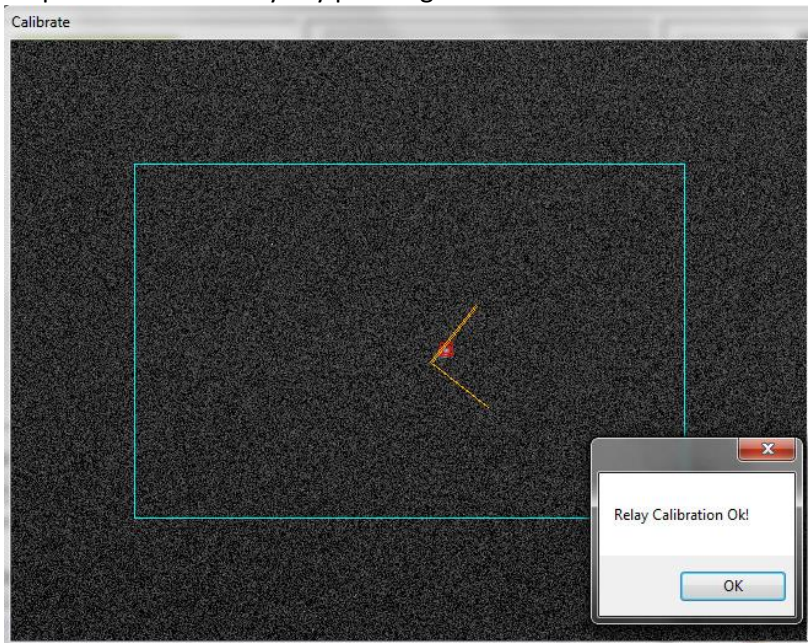
Press “Stop” if you are perfectly focused.

On cameras with internal guide chip normally it should be focused now. However, you can do this focus function also with the button “Focus” in the Guide panel.

Step 11: Find a guide star

Use “Focus” in the Guide panel to position a guide star approximate in the middle of the guide chip.

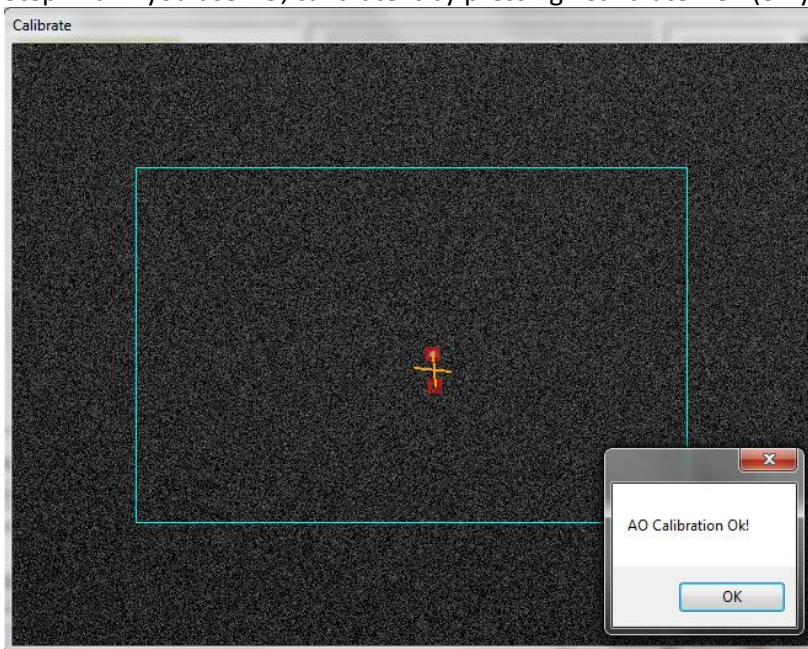
Step 12: Calibrate relays by pressing “Calibrate” button



If there are problems with calibration, look at the detailed description.

If you use small focal length telescope you should uncheck “Remove Hotpixel” in the “Setting” window (look at chapter Settings).

Step 12a: If you use AO, calibrate it by pressing “Calibrate AO” (only first time necessary)



You have to check the box “AO” if you want to use AO optics.

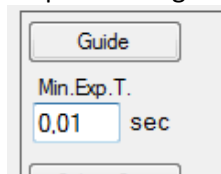
If more than one stars is recognized, you get a message and you have to select the preferred star at each calibration image with a mouse click. If you have selected “Pattern: Use it for Calibration” in the “Settings” window, SbigControl works with a star pattern match algorithm and should work automatically with more than one star.

Step 13: Select the guide Star by pressing “Select Star”

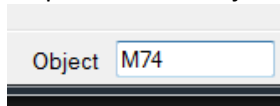


Click on the guide star

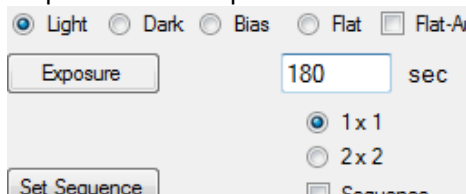
Step 14: Change the minimum guide exposure time if you want and start guiding with “Guide” button



Step 15: Set the object name



Step 16: Set the exposure time and binning



Step 17: Start exposure by pressing “Exposure”

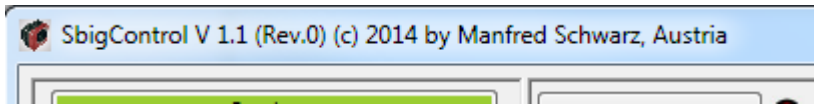
After finishing an exposure, your image is automatically stored in a sub-folder under the working directory.

The folder name is a compound of date and object name, e.g. 2014-04-21_M74

The file name is a compound of object name, filter, binning, exposure time, temperature and running number, e.g. M74_L_1x1_180s_m20C_001.fit

Detailed description of functions

Title line of the main window



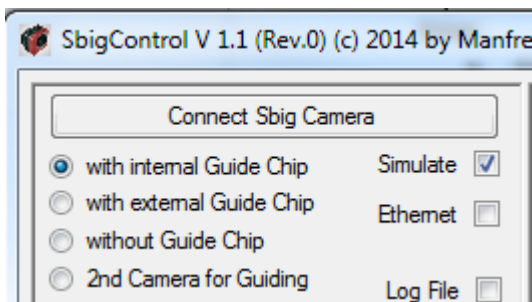
Next to the program name SbigControl you find the software version number e.g. V 1.1 and the revision number (Rev.0).

Configuration first time only

If you always work with the same camera setup, you need to set the following parameters only at the first time:

- Kind of guide chip
- Filter wheel
- Filter names
- Options
- Working Path

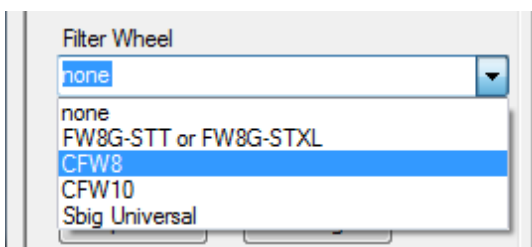
Kind of guide chip and camera interface



- "with internal Guide Chip": your camera has an internal guide chip (e.g. ST-10)
- "with external Guide Chip": external remote chip or a chip in a self-guiding filter wheel
- "without Guide Chip": only imaging, camera without guide chip
- "2nd Camera for Guiding": separate camera for guiding (e.g. STi)

If your camera(s) works with Ethernet connection, check "Ethernet". After connecting, the IP address of the main camera is displayed under "Ethernet" checkbox.

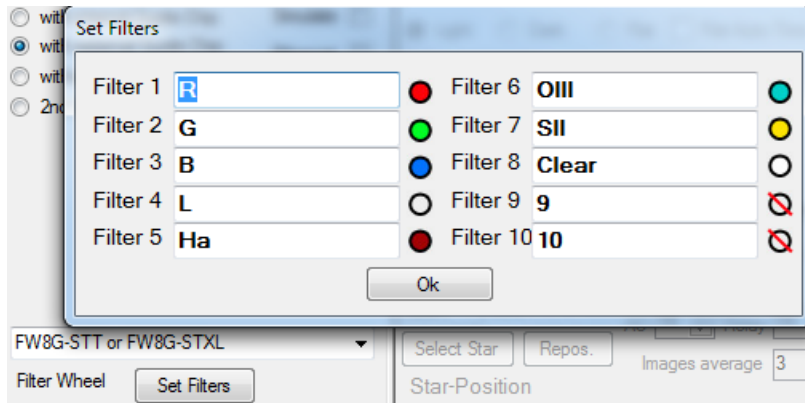
Filter Wheel



Choose your filter wheel from the list.
If you don't have a filter wheel, select "none".
If you don't find your filter wheel in the list, select "Sbig Universal"

If you don't have a listed filter wheel and are having troubles with selection "Sbig Universal", please report it. I will add your filter wheel in the next revision.

Filter Names



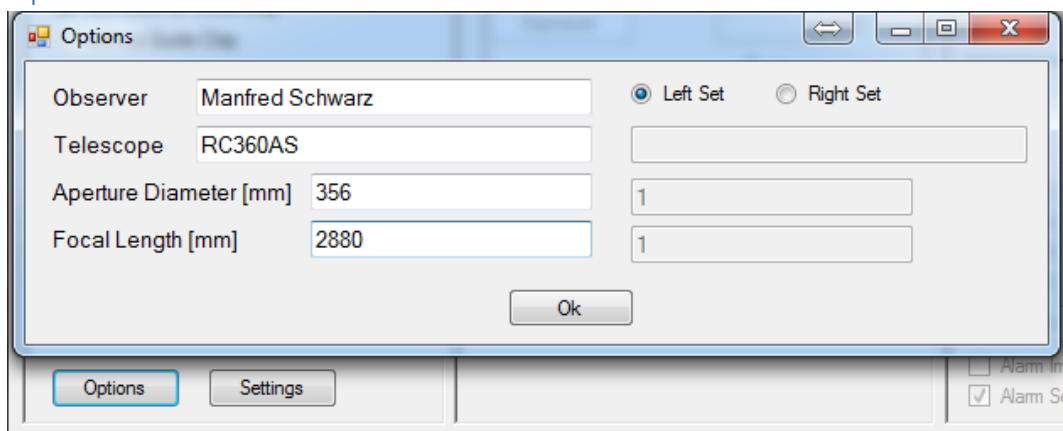
After pressing “Set Filters” a new window pops up. There are up to 10 filter positions.

Here you can define your filter setup.

The filter names are also stored in the FITs header of your images and in the file names.

Click on the color symbols beside the filter names to change the color of the symbol.

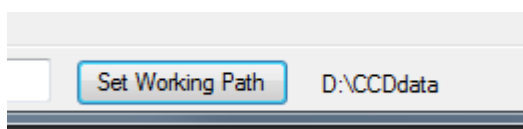
Options



These parameters are stored in the FITs-header of each image.

You have the possibility to define 2 different telescope settings and switch easily by selecting “Left Set” or “Right Set”.

Working path and folder/file structure



The working path is the base folder for auto-save.

Each exposed image from the main chip is stored automatically in a sub-folder of working path. The sub-folder name is a combination of date and object name (see below).

The date range is not the same as the normal clock-range, that means:

- Images taken from 8am to 12am have the actual date
- Images taken from 12am to 8am have the date of the prior day

There is a practical reason for this. You will imaging over midnight and want all images from one object in the same folder.

Example: Working path D:\CCDdata, Object M51, date 21th April 2014, time 1:30am

Sub-Folder: D:\CCDdata\2014-04-20_M51\

The image name is a combination of several parameters:

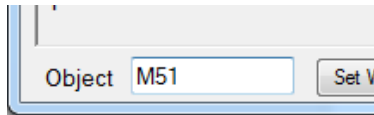
- Prefix, if you have entered one
- Object name or “Bias” or “Dark” or “Flat”

- Filter name (not for bias or dark frames)
- Binning “1x1” or “2x2”
- Exposure time (“180s” for 3 minutes or “0s45” for 0.45 seconds)
- Chip temperature in °C (“15C” for +15°C or “m20C” for -20°C)
- Running number to avoid an overwrite of images

Example:

M51_L_1x1_180s_m30C_001.fit

Object name

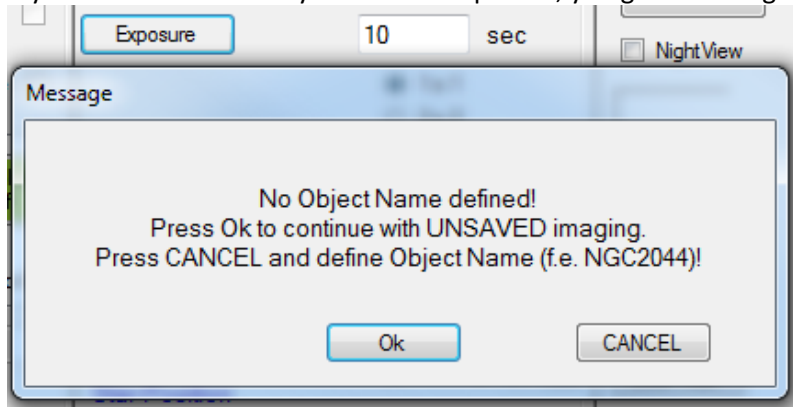


Enter the name of the object.

This is stored in the FITs-header and is a part of the auto-save folder and filename.

You can only use characters which are allowed in file names!

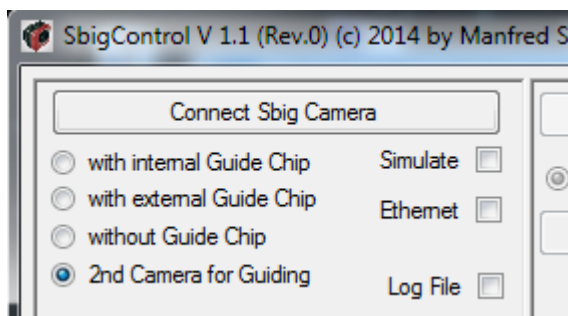
If you leave it blank and you start an exposure, you get following warning:



If you want to take only an unsaved test image, press “Ok”. Otherwise, press “Cancel” and fill out the “Object” field.

Connect your SBIG camera

SbigControl supports Sbig cameras with USB or Ethernet ports. After connecting the camera with a USB or Ethernet cable to your PC and powering on the camera, you can press “Connect Sbig Camera”.



Don't forget to check “Ethernet” if you want to work with Ethernet. Ethernet is slower than USB for downloading images from the camera!

If you are working with Ethernet connection, your firewall will display a warning that SbigControl.exe want to access your network. Allow it!

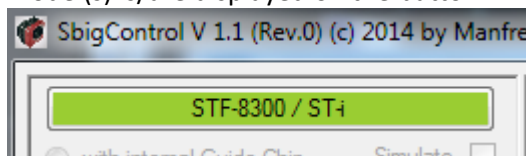
The recognized IP address of the main camera is shown under the Ethernet checkbox after connecting.

If you have checked “2nd Camera for Guiding”, you have to select main and guider camera.



SbigControl remembers this combination at the next start.

After initializing the camera, the connect button turns to a green color and the name(s) of the camera model(s) is/are displayed on the button.

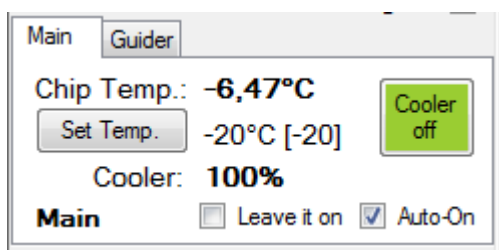


Disconnect the SBIG camera

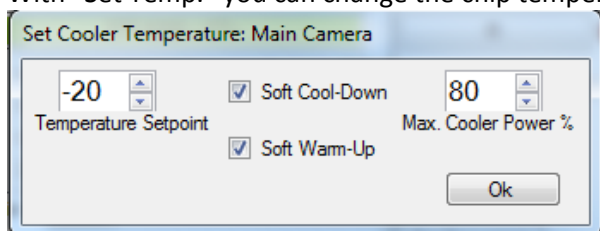
Press the green button with the camera name to disconnect the camera from SbigControl. You should do it before you disconnect the USB or Ethernet cable or power off the camera. The cooler is switched off automatically, if "Leave it on" is unchecked (look below).

If you close SbigControl with the red "X", the application forces a disconnect before closing the windows.

Cooler



With "Set Temp." you can change the chip temperature set-point.

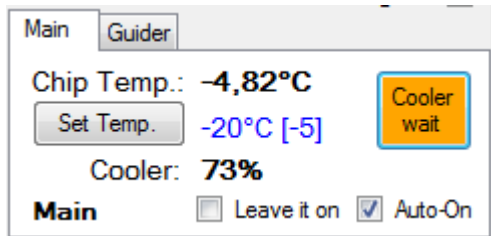


Enter the desired temperature.

If you check "Soft Cool-Down", SbigControl cools down in a soft way, especially in the area of 0°C. This should avoid freezing of the chip.

In this case, you can set the desired temperature without making small manual steps.

If you check "Soft Warm-Up", SbigControl does not switch off the cooler immediately. The cooler steps up in a soft way, especially in the area of 0°C. This should avoid condensation water on the chip.



After pressing “Cooler off” the button turns to orange.

After reach more than +5°C, the cooler turns off automatically.

“Max.Cooler Power %” is to limit the maximum cooler power to avoid disturbances in the image from the cooler.

If it is not possible to reach the set point temperature with the entered maximum power, SbigControl adjusts the internal set point automatically increasing by 5°C after 5 minutes. That makes it easier to handle dark-libraries.

Example: your set point -30°C is not reached with entered maximum power: the adjusted internal set point = -25°C. In this case, the displayed set point turns to a blue color.

If the power of the cooler falls, SbigControl try to set the desired temperature again.

“Auto-On”: Really, I’m one of the persons who often forget to start the cooler and consequently I loose the first images because the chip is at ambient temperature. Check this field to switch on the cooler automatically after connecting the camera.

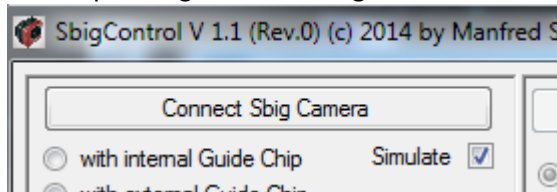
If you have not checked the “Auto-On” option, press: “Cooler On” to start the cooler.

“Leave it on”: If you want to disconnect the camera and re-connect it again later in the session, and you want the cooler to remain active in between, check this box.

If it is unchecked, the cooler will switch off automatically if you disconnect the camera by pressing “Camera” button or if you close SbigControl with the red “X”.

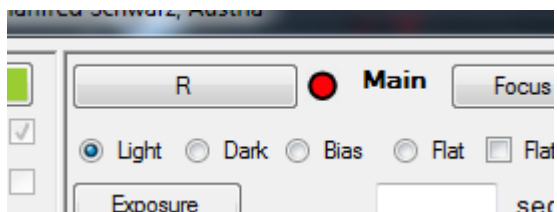
Simulation

If you haven’t connected a camera to your PC and you want to play with the software, check “Simulate” before pressing “Connect Sbig Camera”.



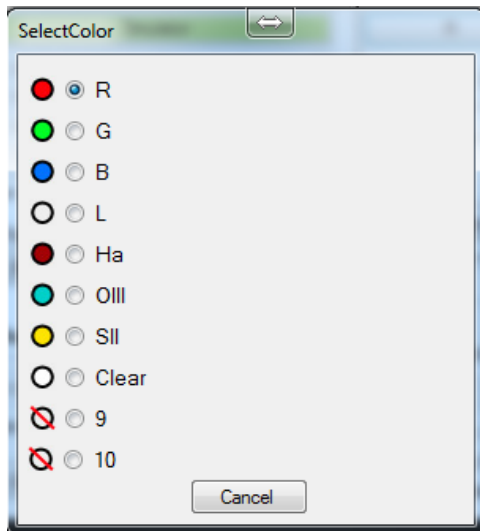
Most functions work in the simulation mode. Try it and have fun!

Choose color filter



In the main camera panel is a button (top left hand side) with the actual filter name. On the right side of the button is a symbol for the filter color. You can define it with “Set Filters”.

Press the button to choose another filter.



Select the required filter and the window close automatically and the filter wheel moves to the selected position.

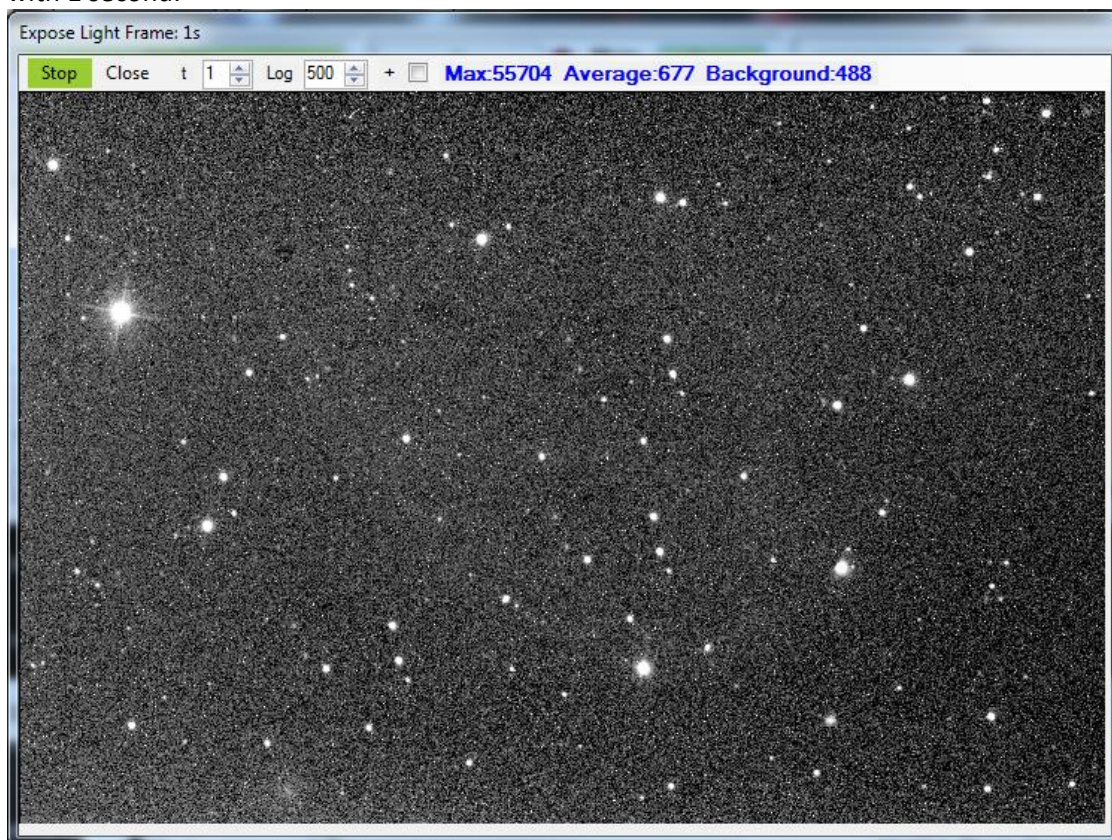
As the filter wheel is working, the button shows "... moving ..."

If you don't want to change the filter, press "Cancel".

Focus main chip

Press "Focus" in the main camera panel.

A new window pops up showing a continuously updating exposure of the main chip starts (dark frame corrected). Normally it is in 3x3 binning, but you can change it with "Settings". The exposure time starts with 1 second.



You can see 3 blue parameters:

- Max: maximum ADU (brightness) value found in this image (a full charged pixel can have normally 65535 but can be lower, it depends on the camera hardware)
- Average: average ADU of all pixels
- Background: background value of the image (left shoulder of histogram)

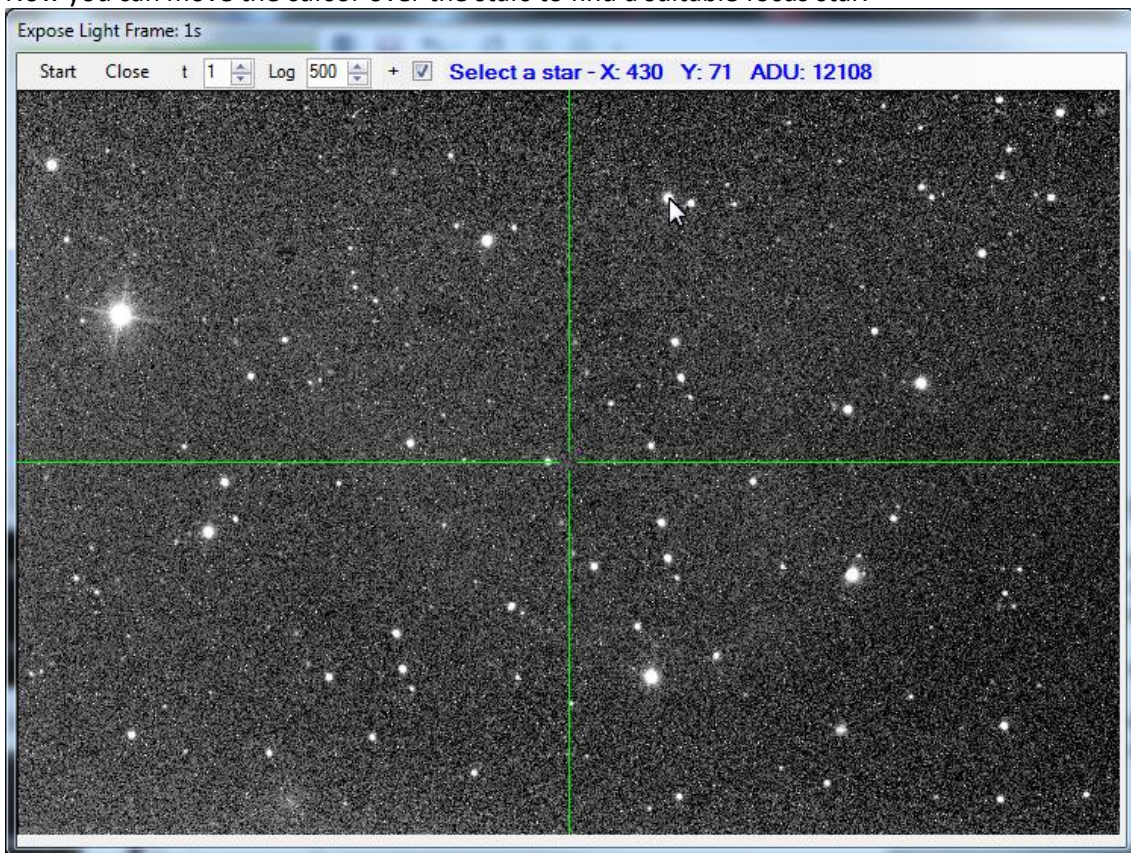
You can switch on a cross-hairs with the “+” checkbox (see below). The change of cross-hairs is shown after next focus exposure.

If you want to change the exposure time, change the value “t”. This represent the exposure time in seconds. The value “0” sets the exposure time to 0.5s

You can change the brightness of displayed images by changing the value “Log”. Lower values generate darker images. You can change it with the arrows (+/- 50) or enter it direct in the field. The change is shown after next focus exposure.

Change the focus of your optics to get optical small stars and press “Stop”, to stop the continuous imaging. Please do not be impatient if the “Stop” button does not turn immediately to “Start”. The current exposure has to be finished before the button changes.

Now you can move the cursor over the stars to find a suitable focus star.



You can see the blue parameters with x and y coordinates and ADU value of the center pixels of the star where the cursor is located.

Take care that you select a star with ADU smaller than 50000 but not too small to get lower exposure time for precise focusing.

Click on the desired star.



Now you get a 120 x 120 pixel sub-window of the chip (size is changeable with "Settings") and a continuous imaging in 1x1 binning. The display is zoomed to 2:1. The exposure time is automatically calculated and shown on the top line in blue (EXP.[s]: ...).

If the star moves because of non-optimal aligned telescope mount, the detailed window moves to hold the star in the middle position. In the header line are the center coordinates of sub-window displayed with X and Y.

On the top line, you find also the actual Max, Average and Background values of the whole sub window.

On the right side, you find in black letters the actual parameters for the brightest star in displayed window:

- Max: maximum pixel value (ADU) of the star
- Value: the average value (ADU) of the star center area (3x3 pixel)
- D: diameter of the star (star size, until ADU-value falls under sub-window-average value)

On the right side, you find in blue letters the best values. Therefore, you can see if you are over the focus. Max and Value are better if higher, D is better if lower.

On the top, you have 2 numeric boxes.

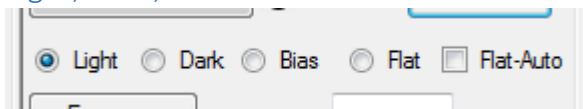
The left one "t" is to change the exposure time in seconds if you are not lucky with the automatic calculated time.

The right one is to change the display contrast (higher values to see more background details).

You can click on the small ▲ and ▼ icons in the boxes to change the value or you can edit it directly in the box.

If you are in perfect focus, press "Stop" or "Close" to close the window.

Light, Dark, Bias and Flat

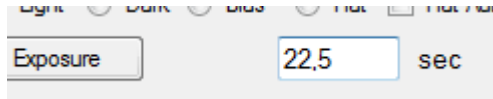


Light and Flat are normal exposures with open shutter. Dark and Bias works with closed shutter. The auto-save file name is different depending on this setting (look at "Working path and folder/file structure").

If you take flat images and you have checked "Flat-Auto", SbigControl find out automatically the best exposure time to get the histogram at appr. 45000 ADU (changeable with "Settings").

Selecting "Bias" turns the exposure time automatically to the lowest possible!

Exposure Time

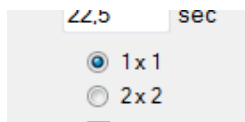


Enter the desired exposure time in seconds.

Attention: if you use a decimal comma, use the right one which is common in your country specific windows version "." or ",",

If you use the wrong one, you get a wrong big value.

Binning



Choose 1x1 or 2x2 binning

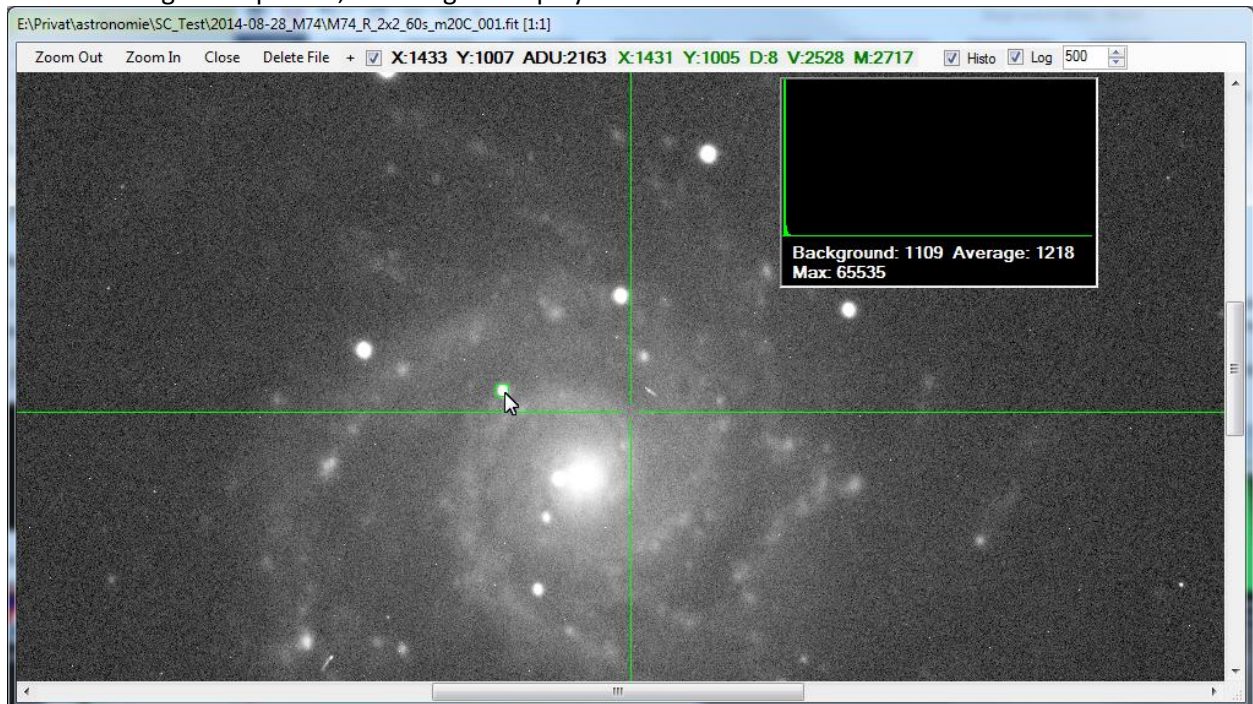
Exposure



After setting all exposure parameters and normally after commencing guiding (see later chapters), you can press "Exposure" to take a single image. After finishing, the image is stored automatically (look at "Working path and folder/file structure").

If you abort the exposure by pressing "Abort" button, the image is not stored!

After finishing the exposure, the image is displayed in a new window.



You can zoom in and out.

Check the box "Histo" to display a histogram with ADU range 0 to 65535.

Check the box "Log" to stretch the display (not the image data) in a logarithmic function.

The histo-display is NOT changed with logarithmic display (changed at SbigControl V 1.1).

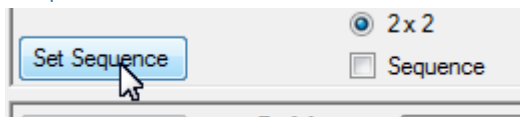
Check the box "+" to get a cross-hair

A change of the numeric value changes the stretch parameter of the display if "Log" is checked. A higher value makes it brighter.

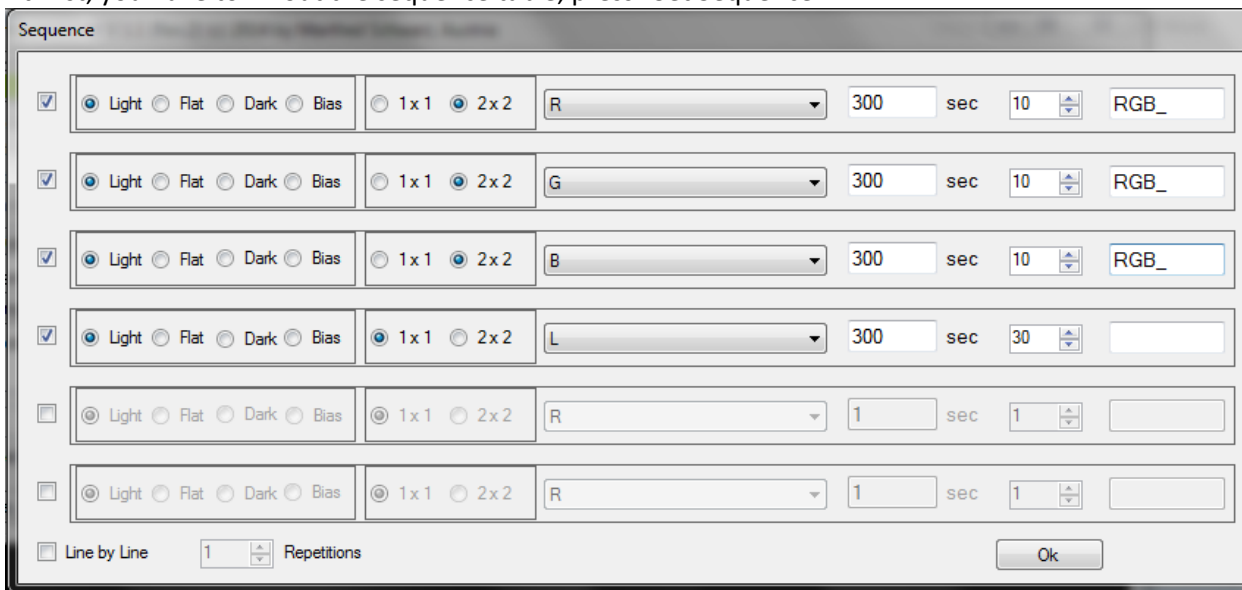
If you move the cursor over the image, you can see on the top line in black letters: X and Y position and the pixel ADU value.

If you click on a star, you get a green rectangle on the display (not in the data) and on the top line in green letters: X and Y position, D: diameter of star in pixel, V: average value of the star center area, M: maximum ADU in the star center.

Sequence



At first, you have to fill out the sequence table, press “Set Sequence”.



You have to check the left check-box if you want to use the sequence line.

Then you have to choose Light /Flat/Dark/Bias (in example all images are Light).

ATTENTION: Do not mix Light and Flat in one sequence.

ATTENTION: if guiding is active, do not start a sequence with Dark or Bias (closed shutter).

Next you have to set the binning 1x1 or 2x2 (in example Light is 1x1, RGB is 2x2).

Next you have to select the filter. If you have no filter wheel, this selection is without effect.

Next you have to set the exposure time in seconds (in example Light is 600s, RGB each 300s)

Next you have to set the number of images you want (in example Light 30, RGB each 10)

Lastly you can add a prefix for the file name (in example R, G and B get a prefix “RGB_”)

Press “Ok” to close sequence table.

If the field “Line by Line” is unchecked, the sequence take one image of the first active line, the next of the second active line, and so on. After reach the last position, the next image of the first active line is taken, and so on.

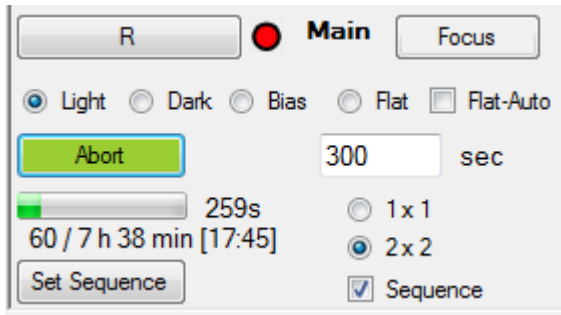
If the field “Line by Line” is checked, the sequence takes all images of first active line, then all images of second active line, and so on.

This makes sense if you take flatfields for different filters in a sequence!

If the field “Line by Line” is checked, you can change the field “Repetitions. For example: the value is 2, the sequence is working line by line. After finishing, it reruns again.

Check the box “Sequence” and the “Exposure” button turns to “Sequence” button.

Press “Sequence” and take one coffee or more....

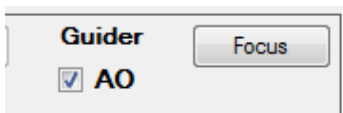


Under the “Abort” button you see the bar for remaining time of the actual exposure.

Below of it there is the number of remaining images and the sum of exposure time (included pauses for dithering, filter change and download image. The pauses time is defined in “Settings”). Then you see the estimated end time of the sequence.

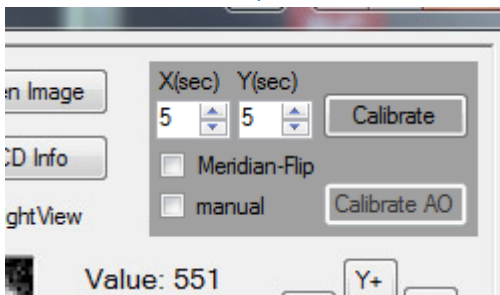
If you have checked “Automatic Refind” and the guide star is lost during a sequence, the current image is aborted. After refind-procedure automatically finds the guide star, the sequence continues and starts automatically with the aborted image again.

Focus of guide chip



The same procedure as focusing of main chip, please read this chapter (page 18).

Calibration of relays and AO



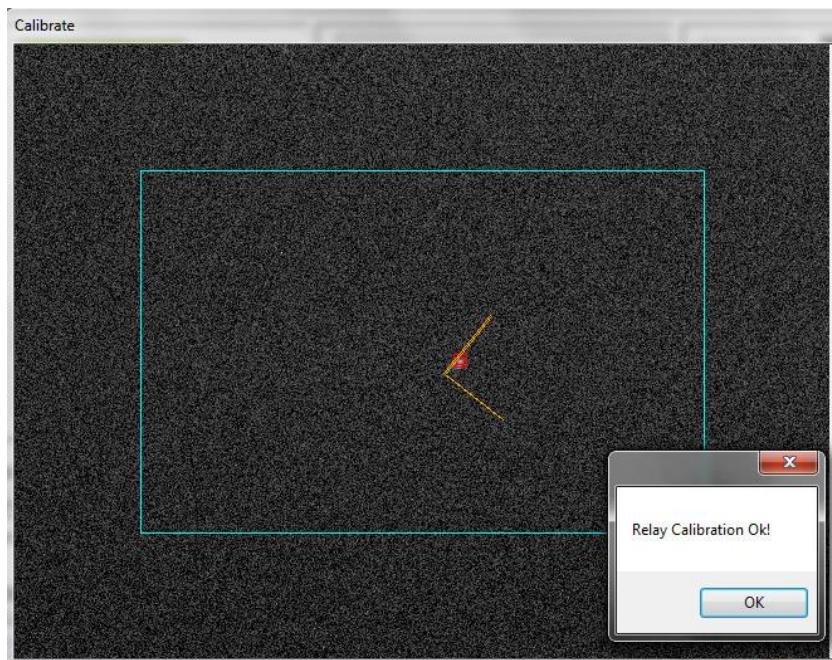
Be sure that you have connected the guiding port of camera with the guider port of your mount.

“X(sec)” and “Y(sec)” are the times for moving the X (RA) and Y (DEC) of the mount during the calibration.

The time depends on the focus length. Small focus length needs longer time to get the minimum pixel move for calibration. You must find out the optimum parameters for your equipment by trial and error.

At first you should position a star (not too weak) in approximate the middle of the guide chip by using “Focus” in the Guide panel.

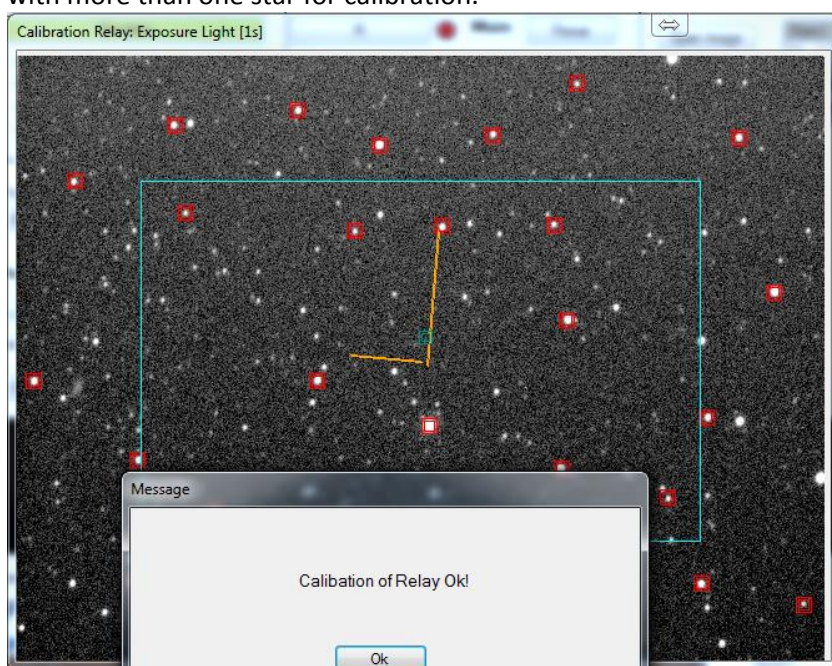
Press “Calibrate” to start calibration for relays.



The calibration works automatically and you will see a result, like the upper example.

If there are more than one stars in the blue rectangle and you haven't selected star pattern match for calibration in "Settings", SbigControl asks you to select the best star manually to avoid a confusion.

If you have checked the Parameter "Pattern: Use it for Calibration" in "Settings", SbigControl can work with more than one star for calibration.



If the automatic process produces a wrong result (takes in one step the wrong star, or the axis are not in a right angle), check the box "manual" and do the calibration again.

The calibration data are stored in a file, so if you close SbigControl and open it again it is not necessary to calibrate again.

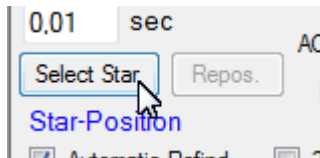
Only if you change the camera rotation against the mount axis or you change the declination axis of your telescope mount more than 5° or you make a meridian flip of your mount will you have to calibrate the relays again!

If you have an AO, you have to calibrate it with “Calibrate AO” for one once. You do not need to calibrate it every night. Only if you demount the AO from the camera or if you install SbigControl on another computer will you have to calibrate it again.

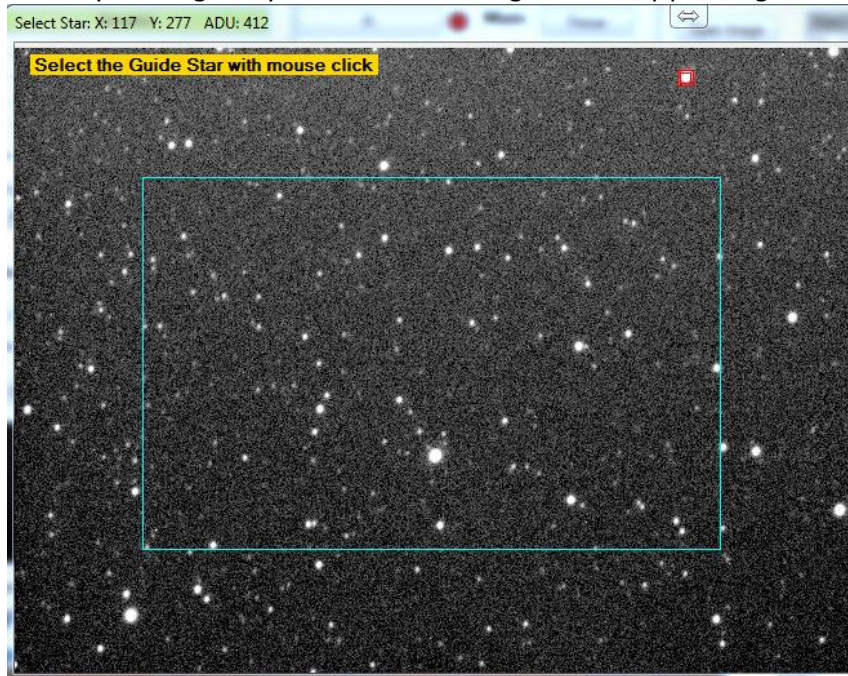
“Meridian-Flip”: if this box is checked, the relay Y axis changes direction. You can use it after a meridian flip, if you don’t rotate the camera and you do not want to make a new calibration.

In simulator mode, the calibration data are stored only if you have never done a calibration before. This avoid overwriting real calibration data by simulator.

Select a guide star

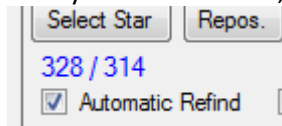


Before you can guide you have to select a guide star by pressing “Select Star”.



SbigControl finds automatically the best guide star. If there are more than one star, the best star is marked, but you can choose your preferred star by yourself. In this case click on the preferred guide star.

Now you can see the X, Y position of the guide star in blue letters.



If the message “Refind Guide Star” appears, SbigControl moves the guide star back to this position on the chip!

Automatic refind of guide star

Check the box “Automatic Refind” if you want that SbigControl to refind and reposition guide star automatically if the guide star is lost.

If you don’t check it and the guide star is lost, guiding stops and also the imaging sequence stops.

Manual Reposition of Guide Star

Every time you press “Select Star”, Sbigcontrol stores following files in the folder C:\SbigControl\GuideStarData:

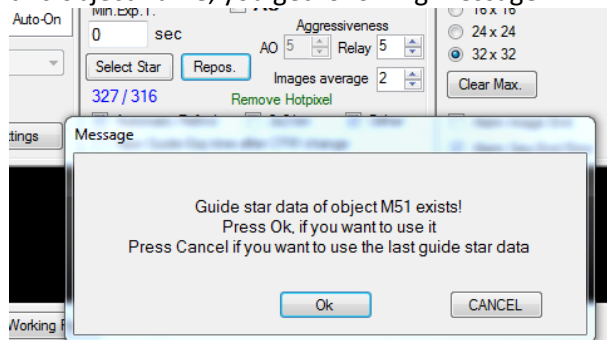
- __Actual_Dark.fit ... the dark frame image of guider
- __Actual_Light.fit ... the light frame image of guider
- __Actual.txt ... the parameters of selected guide star

If you have entered a name in the field “Object”, you get additional following files (example: Object name is M51):

- M51_Dark.fit ... the dark frame image of guider
- M51_Light.fit ... the light frame image of guider
- M51.txt ... the parameters of selected guide star

If you want to bring the guide star automatically on the last position on chip, press “Repos.”.

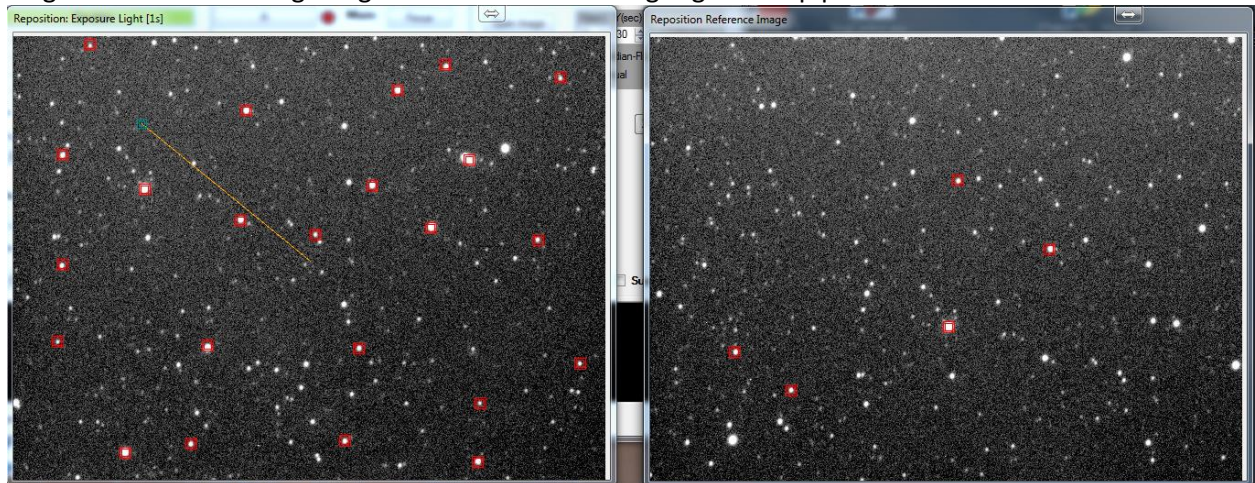
If you have entered a new name in the field “Object” and there already exists reference data with this object name, you get following message:



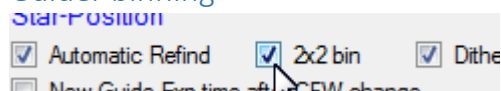
With “Ok”, the existing reference guide star will be taken and the actual reference guide star will be overwritten. With “Cancel”, the actual reference star will be taken and the object reference star will be overwritten.

Two windows opens, one with the reference image, one with the actual image.

SbigControl tries to bring the guide star back on the right guide chip position.



Guider binning

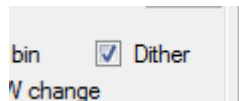


You should only check the “2x2 bin” of Guide panel if you cannot find a bright enough guide star.

Normally the guider works in 1x1 binning. This is more precise than guiding in 2x2 binning.

If you already had selected a guide star and you change the binning of the guider, then you have to select the guide star again!

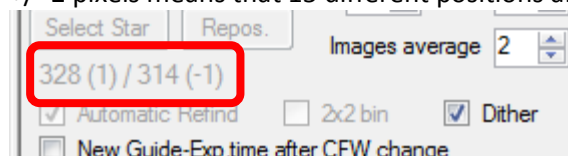
Dither



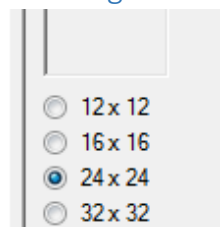
Dithering is to move each image a little bit to avoid the bad pixels that are always on a fixed position. With dithering it is easy to remove bad pixel with your processing software.

If “Dither” is checked, SbigControl holds on to the guider after each image and moves the guide star in a random direction with random number of pixels (maximum +/- 2 pixels) against the origin selected guide star position.

You can see the actual position deviation from the initial star position display in the parenthesis. +/- 2 pixels means that 15 different positions are possible.



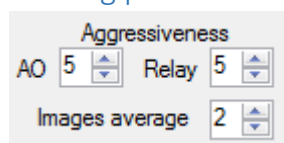
Size of guide window



You can change the size of the guide window. The effect of this is that the guiding speed increase a little bit, but not much. Therefore, normally it is better to have a bigger window to avoid losing the guide star by disturbances such as wind or vibration of the mount.

However, it is also a question of focal length and seeing, in deciding to decrease window size.

Guiding parameters: Aggressiveness, Image average



These are very important parameters to get a good guiding result. The parameters depend on your equipment (focal length, mount reaction time, ...) and also on the actual seeing and wind influences.

“Image average”:

SbigControl corrects the AO and/or the relays after each guiding exposure. But if there is a greater value than 1 entered in this field, the average of deviations of the last guider images (e.g. Image average=4, the last 4 images) to the optimal position is the basis for correction.

With this parameter you can smooth the reaction to avoid over-reactions.

If you use AO and need very high frequency of corrections, this parameter should be small (1 or 2).

“Aggressiveness”:

If the software recognize a deviation of the guide star position, it calculates the vectors to correct the differences. But normally, if you correct it 100%, you get an oscillation through overcorrection.

Change this parameter to avoid this. The optimal correction is a combination of “Image average” and “Aggressiveness”.

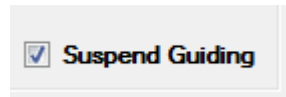
Formula for relay correction: $\text{correction} = \text{deviation} * \text{Aggressiveness\_Relay} / 50$

Formula for AO correction: $\text{correction} = \text{deviation} * \text{Aggressiveness\_AO} / 10$

If you guide with AO and the tilt is higher than, for example, (+/-) 40% (parameter defined in “Settings”), the relays will activated to reposition the AO.

These parameters can changed during guiding, so you can see the reaction immediately!

Suspend Guiding

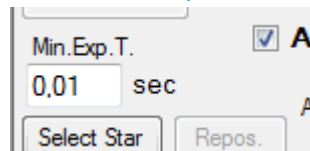


Check “Suspend Guiding” if you want to see the difference between guided und unguided imaging in the guiding window.

That makes sense in determine if jumping star is a result of overcorrection or not.

An acoustic signal reminds you to uncheck it before you start imaging.

Minimum exposure time

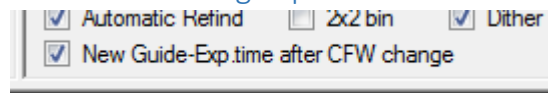


The minimum guider exposure time is usually 0.01s for Sbig guiding chips.

However, sometimes it makes sense to increase this time. If you are working without AO and you don't want the guider react to the poor seeing, then you should increase this value to 0.5s or higher.

Normally the guider finds the minimum exposure time automatically to guide as fast as possible. But if the automatic time is lower than “Min.Exp.T.”, the exposure time will set to this value.

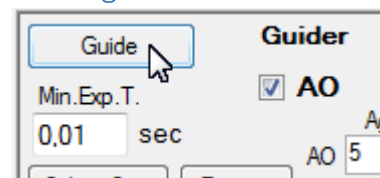
Find new Guiding Exposure Time after Filter change



If you have an internal guide chip behind the filters, it makes sense to check this box!

Every time the filter is changed (by button click or sequence), the guider makes a test exposure and calculates the new guiding exposure time for this filter, before starting to image.

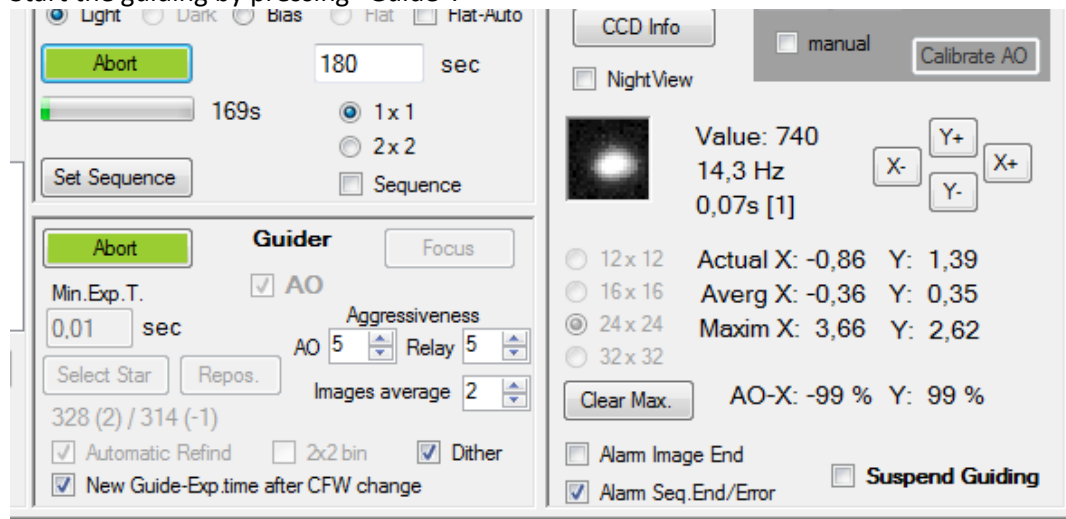
Guiding



Before you can start guiding, SbigControl needs calibrate the relays and, if AO is checked, AO also.

You must also select a suitable guide star.

Start the guiding by pressing “Guide”.



Now you can see many parameters to the right of the guiding window:

- Value: actual ADU value of the star center area (average of centered 9 pixel)
- Hz: actual guiding rate in Hz (correction per seconds)
- Exposure time: actual guiding exposure time, [exposure set] – look at description below
- Actual X/Y: actual deviation in pixels
- Averg X/Y: average of deviation in pixels of the last 8 seconds (maximum 100 values)
- Maxim X/Y: maximum deviation in pixels since the guiding or imaging started
- AO-X/Y: tilt of AO (-100% to +100%, 0% is centered)

Button “Clear Max.”: clears the “Maxim” value, also during guiding.

After starting the guiding, SbigControl takes a dark-corrected image with 1s exposure time to calculate the optimum exposure time for fast guiding.

After that, it takes 5 dark frames to be able to change the exposure time during guiding on the fly.

Exposure time sets:

1: 0.5 * optimum exposure time

2: 0.75 * optimum exposure time

3: optimum exposure time

4: 1.5 * optimum exposure time

5: 2 * optimum exposure time

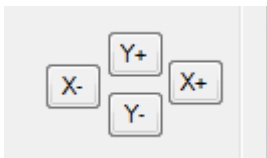
The guiding starts with exposure time set number 3: (optimum exposure time).

If the star value falls under “Start: min. ADU” minus “fade diff. ADU” (look at “Settings”) for more than “fade react [s]” time, the exposure time-set will incremented by 1.

If the star value goes over double of “Start: min. ADU” for more than “fade react [s]” time, the exposure time-set will decremented by 1.

If the star is lost more than “Loose Star Abort [s]” time, the guiding breaks and if “Automatic Refind” is checked, the guide star will searched and repositioned automatically.

Moving mount manually over guider port

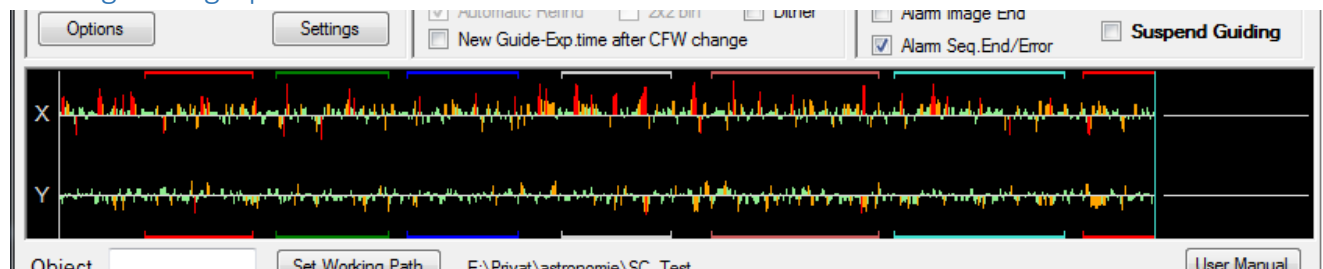


You can move the mount via the guider relays by pressing one of the 4 X/Y buttons.

The mount moves so long as the button is pressed (minimum 0.1s).

If guider is active, you can also see relay actions by the green color of the active guide relay.

Guiding error graph



Each measured guide star deviation from the target guide star position on the chip is shown in this graph as a guiding error for X and Y axis. That means if you have a guiding speed of 8 Hz you get 8 values per second.

Lines over the middle-line shows positive deviation, under the middle line: negative deviation.

- Green color: error ≤ 1 pixel

- Orange color: error ≤ 2 pixel
- Red color: error > 2 pixel

The blue line shows the actual position.

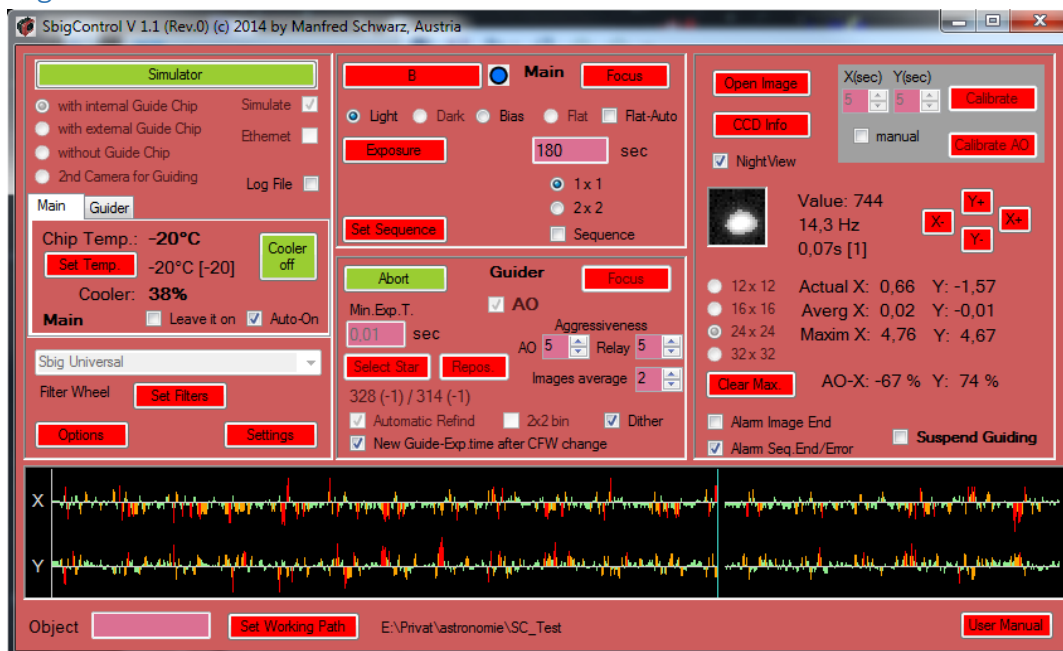
The colored lines on the top and bottom shows the imaging phases according to the used filter.

The graph display shows the last 800 guiding errors.

CCD Info

Press “CCD Info” to get the complete camera information.

Night View



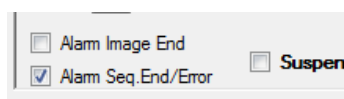
Check “Night View” to turn the control window to red.

Open image

Press open image to view a stored FITS file.

The handling is the same as the viewed exposure image (look at page 21)

Acoustic Alarms



If you check “Alarm Seq. End/Error” you will get, at the end of a sequence or after an abort sequence through error, an acoustic alarm (my favorite if I have to go to work next morning and I want to have some hours sleep during exposure).

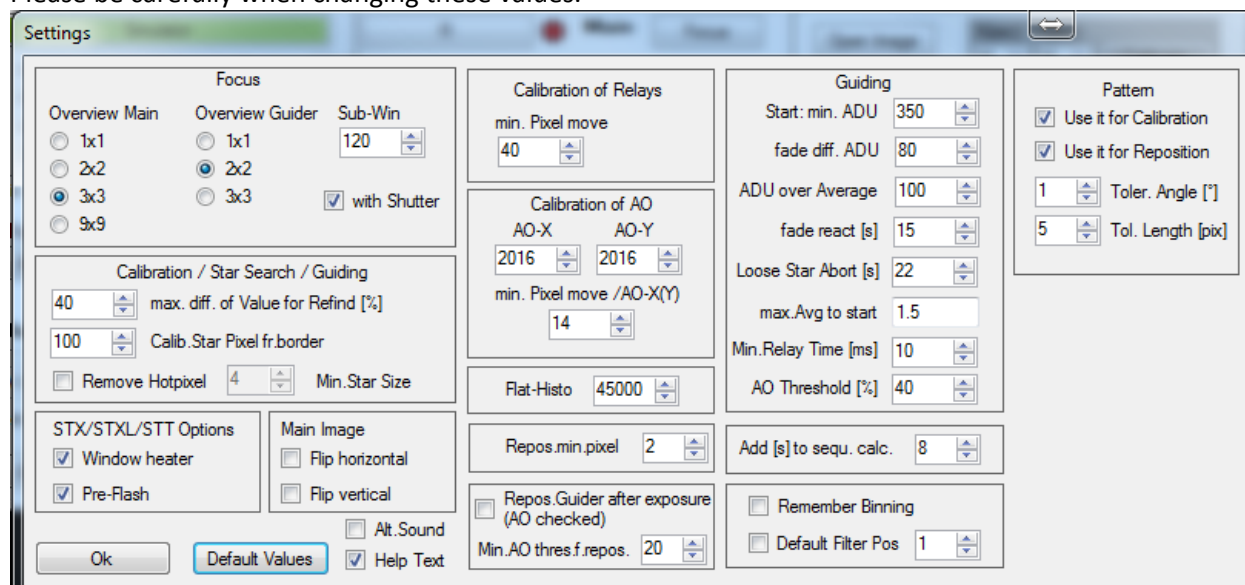
If you check “Alarm Image End” you get an acoustic alarm for every exposure image.

User Manual

Press “User Manual” to get this manual in PDF format on the screen. You need a PDF viewer installed on your PC.

Settings

Please be carefully when changing these values.



The above window shows the default values.

Focus settings

You can change the focus overview binning of main chip: 1x1, 2x2, 3x3 (default) and 9x9. 9x9 is not possible for all camera types (please check it before you use 9x9 binning).

You can change the focus overview binning of guide chip: 1x1, 2x2 (default) and 3x3.

You can change the size of the detailed focus window. A smaller size makes the update response time for focusing faster. Default: 120

On some chips you get white stripes on stars if the shutter is permanently open during focusing. In this case check "with Shutter" to avoid this. The focus speed decrease with shutter use.

Calibration of Relays

Here you can change the minimum number of pixels the star has to move on the calibration. Higher values makes the result of calibration better. Default: 40

If you have a small focal length, decrease this parameter. It makes no sense to go under 5 pixel.

Calibration of AO

AO-X and AO-Y are DAC-Values for the Digital/Analog converter of the AO tip/tilt mechanic. The maximum value of AO = +/- 2047. These two parameters set the tip of AO for X and Y on calibration. Higher values are better. Default 2016.

The 3rd parameter is the minimum number of pixels the star has to move during calibration. Default: 14.

Calibration / Star Search / Guiding

"max. diff. of Value for Refind [%]" is the maximum value change in % to accept a refind star.

This is needed on calibration and on refind guide star. Default: 40

If you have problem where the wrong star is found permanently, try to lower this value.

"Calib. Star Pixel fr. border" sets the number of pixel that the guide star has to be away from the border for calibration (blue rectangle in calibration window). Default: 100

"Remove Hotpixel" should prevent the guider taking a hotpixel as a guide star.

If you have very small stars (small focus length and/or big size pixels, undersampled), you should uncheck this parameter! For bigger focal lengths (oversampled) it makes sense to check it, to avoid hotpixels are recognized as stars. If it is checked, a median filter is used for the guider images.

“Min.Star Size” is only available if “Remove Hotpixel” is checked. It is the minimum diameter of star to accept it as star. If still hotpixels are accepted as guide stars, increase this parameter.

Flat-Histo

For Auto-Flat-Time you can set the target value in histogram. Normally should be over the middle of maximum ADU values. Default: 45000

Guiding

“Start: min. ADU” is the base for calculating the guiding exposure time at the beginning of guiding. This ADU value is the target star ADU value for guiding.

Is the star ADU is greater than the double of “Start: min. ADU” for more than “fade react [s]” time, the next lower exposure set becomes active.

Is the star ADU is lower than “Start: min. ADU” minus “fade diff. ADU” for more than “fade react [s]” time, the next higher exposure set becomes active.

For calibration, guiding and all functions where there is a need to find the star center, the value “ADU over Average” is important. An ADU value over the actual image or sub-image average value is necessary to accept it as a star.

The reason for this is to avoid interpreting noise as stars. If you lower this value, weaker stars are accepted but also more noise errors occurs.

“Loose Star Abort [s]” is the time in seconds to break guiding after a star is lost. If “Automatic Refind” is checked, the guiding starts automatically after SbigControl has the guide star found and repositioned.

“max.Avg to start” is the maximum permitted size of the pixel deviation (averaged guiding error) to starts the imaging. This avoids starting the image if the guiding is unstable, after filter moving for example. You can see the average guiding error for X and Y on the right side of guiding window (Averg X/Y).

If you press “Exposure” or if the sequence wants to start the next exposure and the “Averg X/Y” values are greater than “max.Avg to start”, SbigControl delays starting imaging.

It makes no sense to send ultra-short impulses to the relay inputs of the mount. Set the “Min.Relay Time [ms]” to a value, which makes sense for your mount. Default: 10 milliseconds.

“AO Threshold [%]” is the maximum of AO-tilt before relay correction is done. You can change it between 20% and 80% (default: 40%).

Repos.min.pixel

Is the value, which is the maximum deviation in pixels that are allowed after reposition. Default: 2 pixel.

Repos.Guider after exposure (AO checked)

If you are working with AO and want imaging to start with a centered AO, you can check this box. The “Min.AO thres.f.repos.” value is the minimum tilt of AO in %, over this value the reposition starts before the next image.

Add [s] to sequ. Calc.

The time estimate for a sequence to end is the sum of exposure times and other times like:

- Image download time
- Filter change time

- Time for finding new guider exposure time

For these “other times” you can enter an approximate value, in second per image, to get an estimated end-time for the entire sequence. Default: 8s.

Remember Binning and Default Filter Pos

Both these parameters have an effect on starting SbigControl and on end of sequence.

“Remember Binning” records the last selected binning (on closing the application), and uses it on starting SbigControl. Also the binning set before sequence is set back at the end of sequence.

“Default Filter Pos” is to set the filter position automatically after starting SbigControl or finishing a sequence to the entered filter position. For example you have defined Luminance at filter position 4 and you want to have this as default filter, check this parameter and enter the number 4.

STX/STXL/STT Options

STX, STXL and STT camera models support “Window heater” and “Pre-Flash” function. Check the parameter if you want to activate it.

If you have another camera model, these parameters have no effect.

Main Image

Depending your optics, it is possible that your image is mirrored. You can flip it horizontally or vertically. If you check both, it is not mirrored, it is rotated by 180°.

Pattern

SbigControl can operate with star pattern match in case of calibration and/or re-position. That’s very helpful in case of small telescope focal length.

Pattern Match is done in following way:

In the first image on calibration or in the reference image on re-position, SbigControl search in the center rectangle the 5 brightest stars. Then it builds triangles for all possible combination of the 5 stars. The software gets a lot of vectors with length and angles.

On the next image all bright stars will marked and all possible combinations of triangles will calculated. Then SbigControl verify all new data (vector length and angles) with the reference data, to find a correlation.

“Toler. Angel [°]”: maximal allowed deviation of angle in °

“Tol. Length [pix]”: maximal allowed deviation of vector length in pixels

Help and Sound

“Help Text”: Check it to get help text if you move the cursor over a control or text (all important controls and text are supported).

“Alt. Sound”: Check it to get an alternative sound on alarm. Bell-ring instead of alarm-siren.

Default Values

If you had made a mistake in parameter settings, you can press “Default Values” to set all settings back to default values.

Log File

If you check “Log File”, all auto-saved exposures are logged in the file “log.csv” in the same folder as the images are stored. You can open it, for example with Microsoft Excel. Do not open during imaging, because Excel locks the file and it is not possible for SbigControl to write additional data to this file.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
File	Camera	Start-Time	Exp.Time [s]	Filter	Temp.[°C]	Binning	Guide-Exp.T	Guiding[Hz]	AO	Corr-X	Corr-Y	Max-X	Max-Y	Guide Star X/Y
M104_L_2x2_30s_-36°C_001.fit	STXL-6303	19:33:00	30 L	-35,8	1x1	0	0	-	0	0	0	0	0	0 Star-Position
M104_R_2x2_300s_-35°C_001.fit	STXL-6303	19:42:55	300 R	-35	1x1	0,08	5,2	no	-0,01	-0,01	0,52	0,54	521 (0) / 193 (0)	
M104_R_1x1_300s_-35°C_001.fit	STXL-6303	19:58:58	300 R	-35,1	1x1	1	0,9	no	-0,02	0	0,52	0,54	343 (0) / 237 (0)	
M104_G_1x1_300s_-35°C_001.fit	STXL-6303	20:05:51	300 G	-35	1x1	0,55	1,7	no	-0,03	-0,02	1,51	0,59	343 (0) / 237 (0)	
M104_B_1x1_300s_-35°C_001.fit	STXL-6303	20:11:23	300 B	-35	1x1	0,51	1,6	no	-0,05	0	0,52	0,54	343 (0) / 237 (0)	
M104_R_1x1_300s_-35°C_002.fit	STXL-6303	20:22:42	300 R	-35	1x1	0,55	1,7	no	-0,05	-0,02	0,58	1,53	343 (0) / 237 (0)	

File: file name

Camera: used Sbig camera

Start-Time: Local time (PC-Time) on starting exposure

Exp.Time [s]: exposure time in seconds

Filter: used filter

Temp.[°C]: main chip temperature

Binning: main chip binning

Guide-Exp.Time [s]: exposure time of guide chip during guiding

Guiding[Hz]: update time for guiding correction in Hz

AO: AO used or not

Corr-X: average correction of X-axis during imaging

Corr-Y: average correction of Y-axis during imaging

Max-X: maximum deviation of X-axis during imaging

Max-Y: maximum deviation of Y-axis during imaging

Guide Star X/Y: X and Y position of guide star. In parenthesis the dither divergence to guide star position is shown (in pixel)

Known Problems

Installation Problem by using Tools like Norton

Some tools mark SbigControl as unknown software and it is possible that the EXE file is deleted by this software or moved to a quarantine area.

In this case, please try to enter an exception for sbigControl.exe in these tools.

Problem on displaying controls and text

The development was made under Win 7 and Win 8.1 with the standard display scheme (e.g. Windows 7 scheme) and with 100% text/control size (standard).

If there are different settings, it is possible that text or controls are bigger and does not fit or are smaller as in the pictures of this manual.

Frequently Asked Questions

After start SbigControl I get the message: "missing MSVCR120.dll"

The "Microsoft Visual C++ 2013 Redistributable (X86)" is missing. Install it by starting vccredist_x86.exe, it is a part of the downloaded installation ZIP file.

My Sbig camera is connected with Ethernet but SbigControl don't find it

You have to set the Ethernet parameters of your Sbig camera before SbigControl can find it.

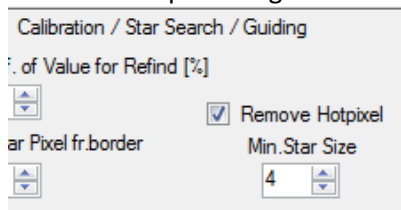
- Connect your camera via USB to your PC and switch it on
- Start CCDops (delivered with your camera, or download it from www.sbig.com)
- Select Camera -> STX/STT -> IP Properties...
- Check DHCP option

- Select Camera -> Shutdown and leave CCDops
- Switch camera off
- Connect the camera to your router or Ethernet switch
- Switch camera on
- Start SbigControl and wait a little bit, it can take time until camera gets the IP from your router
- Check Ethernet on SbigControl and then connect
- The camera should be found now and the IP is shown under the Ethernet checkbox

Why it is not possible to select a displayed guide star?

Also if you can see the star on the display after pressing "Select Star", it is not guaranteed that SbigControl will accept it as star. Two parameters of "Settings" are important for this:

- a) "Remove Hotpixel" together with "Min. Star Size"



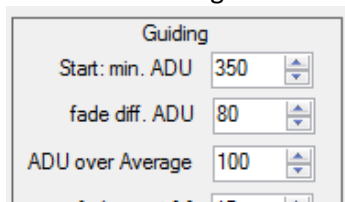
You should only check "Remove Hotpixel" if you are working with longer focal lengths.

If the stars are very small (undersampled) and you have checked it, the software can interpret the star as a hotpixel and not as star.

If you are in a situation of having smaller stars and also hotpixels, you can check "Remove Hotpixel" but you should change "Min. Star Size" to a lower value to find out the limit between real stars and hotpixels.

If you have a long focal length and you have checked "Remove Hotpixel" and still have problems where hotpixel are interpreted as stars, increase "MinStar Size".

- b) "ADU over Average"



To accept a star as a star the following calculation is done:
 $\text{starValue} > (\text{imageAverage} + \text{"ADU over Average"})$

starValue is an average of 3x3 pixel around the star center

imageAverage is the average of all pixels in the image or the sub-image in case of guiding-window or focusing-window.

This calculation is done to get a gap between noise and real data. If you have troubles where weak stars are not accepted, you can decrease the value of "ADU over Average", but the chances to misinterpret a noise as data is higher in this case.

Note: Only if the star is accepted as a star, the "Guide" button become active!

Software Version Release Notes

V1.1 (Rev.2) - 2015-02-07

- Prefix for file names, also for sequence
- No filter name in file name in case of no filter wheel is defined

V1.1 (Rev.1) - 2014-10-17

- Complete reorganization of internal structure (programming structure and camera communication)
- Ethernet support
- Support of extra guiding camera (e.g. STi)
- Continuous update of guiding graph and marking of imaging active
- Cooler: "Soft warm-up"
- Bias radio button: switch automatically to lowest exposure time and file name begins with "Bias_"
- Help text on cursor over control (switchable in Settings)
- Focus and imaging: cross-hair checkbox to find chip center
- Focus: better solution for changing exposure time
- Focus: bigger data display for detailed focus values
- Color Filter: colored symbols additional to filter text
- Select color filter: click on filter radio button changes immediately the filter (no "Ok" press is necessary)
- "New Guide-Exp.time after CFW change" checkbox: if you have a guide chip behind the filter, check it to get new guide exposure measurement after filter change
- Image: "Delete" button to remove the file from disk
- "Object" field: If you have nothing entered in object field, you get a warning that file will be unsaved
- Settings: focus "with Shutter" checkbox. If unchecked, shutter is open during whole focus activity
- Settings: "Flat-Histo": target brightness value for auto flats

- Settings: "Loose Star Abort [s]": time to break the image or sequence if star is lost
- Settings: "Add [s] to sequ. calc.": additional time in seconds per image (for download and filter change) for sequence time calculation
- Generally better handling with buttons and colors of buttons
- Sequence: display the calculated end time, e.g. "23 / 1 h 53 min [22:46]"
- Histogram-Display: shows now every time the histogram of the real data and not the histogram of the displayed data
- Meridian-flip checkbox for relay calibration
- Alternative Sound ("Settings")
- Star pattern match for calibration and re-position
- Detailed focus sub-window follows the star, if it is moving
- Compiled with VC++ 2013, you need Visual C++ 2013 Redistributable
- Installation with setup.exe, no manual file copy is necessary
- .NET 4.5 and Visual C++ 2013 Redistributable downloadable from www.astrophoto.at
- several bug-fixes

V1.0 (Rev.9) - 2014-07-01

- New "Settings" parameter: "Repos.min.pixel" defines the minimum divergence after repositioning the guide star to the target value
- New "Settings" parameter: "Repos.Guider after exposure (AO checked)", after each exposure SbigControl checks the tilt of AO and if it's over "Min.AO thres.f.repos." an automatic reposition follows

V1.0 (Rev.8) - 2014-06-22

- Problem of sometimes shifted images solved
- New "Settings" parameter: STX/STXL/STT "Window Heater" and "Pre-Flash"
- New "Settings" parameter: "Remember binning" to reset binning to last setting after program start and after sequence finishing
- New "Settings" parameter: "Default Filter Pos" to reset filter position to defined filter after program start and after sequence finishing
- New checkbox "Leave it On" to leave the cooler on by disconnecting camera or closing program

V1.0 (Rev.7) - 2014-06-21

- Slow download speed of some cameras solved! Works now with maximum download speed.
- loosing guide star: problem solved that SbigControl switched immediately to guide-step 5 without taking care on "fade react [s]" timeout
- error message: "ERROR: Division through 0: DisFunc.cpp (494)" sometimes if guide star is lost: solved

V1.0 (Rev.5) – 2014-06-15

- New "Settings" parameter: AO-Threshold (previous it was fixed +/- 40%)
- "Abort" button of guide and exposure: shows now "..wait.." after activated but software needs time to abort function
- After pressing "Abort" on guiding, some guiding values are hidden to avoid confusion
- Bug-Fix: Zoom of image window to 2:1 - wrong error message removed
- Bug Fix: Images with width which is not divide-able through 4 was incorrectly displayed before
- Bug Fix: Select Star: if no star found, no coordinates are displayed on star position (previous 0 / 0 was displayed)
- Manual: add FAQ chapter, add version release notes